



06/05/00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
REQUEST FOR FILING NATIONAL PATENT APPLICATION

Under 35 USC 111(a) and Rule 53(b)

Asst. Commissioner of Patents
Washington, D.C. 20231WITH SIGNED DECLARATIONPATENT APPLICATIONNONPROVISIONAL
NON REISSUE
NON PCT NAT PHASE

Sir:

Herewith is the PATENT APPLICATION of
Inventor(s): DE MEUTER, Pascale A.E. et alTitle SUGAR-FREE HARD COATINGS PREPARED FROM
LIQUID MIXTURES OF ERYTHRITOL AND SORBITOL

Atty. Dkt.: PM 270736

CER-93

M#

Client Ref

Date: Monday June 5, 2000

including:

1. Specification: 13 pages (only spec. and claims) 2. ☐ Specification in non-English language
3. Declaration ☐ Original ☒ Facsimile/Copy ☒ Abstract 1 page(s); 8 numbered claims
4. ☒ Drawings: 4 sheet(s) ☐ informal; ☒ formal of size: ☒ A4 ☐ 11"
5. ☐ See top first page re prior Provisional, National or International application(s). ("X" box only if info is there and do not complete corresponding item 5 or 6). (Prior M# SN)
6. **AMEND the specification** please by inserting before the first line: -- This is a ☐ Continuation-in-Part ☐ Divisional ☐ Continuation ☐ Substitute Application (MPEP 201.09) of:
- 6(a) ☐ National Appln. No. / filed (M#)
- 6(b) ☐ International Appln. No. filed
7. ☐ **AMEND the specification** by inserting before the first line: -- This application claims the benefit of U.S. Provisional Application No. 60/ , filed
8. ☒ Attached is an assignment and cover sheet. Please return the recorded assignment to the undersigned.
9. ☐ Prior application is assigned to

by Assignment recorded Reel Frame

- 10.
- FOREIGN**
- priority is claimed under 35 USC 119(a)-(d)/365(b) based on filing in
- GREAT BRITAIN

11. (country)

Application No.	Filing Date	Application No.	Filing Date
(1) 9912813.4	June 3, 1999	(2)	
(3)		(4)	
(5)		(6)	
(7)		(8)	
(9)		(10)	

12. 1 (No.) Certified copy (copies): ☒ attached; ☐ previously filed (date)
- in U.S. Application No. / filed on

13. ☐ Attached: _____ (No.) Verified Statement(s) establishing "small entity" status under Rules 9 & 27.
 14. **DOMESTIC/INTERNATIONAL** priority is claimed under 35 USC 119(e)/120/365(c) based on the following provisional, nonprovisional and/or PCT international application(s):

Application No.	Filing Date	Application No.	Filing Date
(1)		(4)	
(2)		(5)	
(3)		(6)	

15. ☐ This application is being filed under Rule 53(b)(2) since an inventor is named in the enclosed Declaration who was not named in the prior application.
 16. ☒ Attached: Form PTO-1449 and a copy of the Standard Search Report listing the enclosed documents
 17. ☐ Preliminary Amendment:

THE FOLLOWING FILING FEE IS BASED ON CLAIMS AS FILED LESS ANY ABOVE CANCELLED

				Large/Small Entity	Fee Code
18. Basic Filing Fee				\$690/\$345	101/201
19. Total Effective Claims	9	minus 20 =	*0	x \$18/\$9 =	+ 0 103/203
20. Independent Claims	2	minus 3 =	*0	x \$78/\$39 =	+ 0 102/202
				"If answer is zero or less, enter '0'"	
21. If any proper multiple dependent claim (ignore improper) is present, add (Leave this line blank if this is a reissue application)				+ \$260/\$130	+ 260 104/204
22.				TOTAL FILING FEE ENCLOSED =	\$950
23. If "non-English" box 2 is X'd, add Rule 17(k) processing fee				+ \$130	+ 0 139
24. If "assignment" box 8 is X'd, add recording fee				+ \$40	+ 40 581
25. <input type="checkbox"/> Attached is a Petition/Fee under Rule No.				+ \$130	+ 0 122
26.				TOTAL FEE ENCLOSED =	\$990

Our Deposit Account No. 03-3975

Our Order No. 20436 C# 270736 M#

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NOTE: File in duplicate with 2 post card receipts (PAT-103) & attachments

APPLICATION UNDER UNITED STATES PATENT LAWS

Atty. Dkt. No. PM 270736/CER-93
(M#)

Invention: SUGAR-FREE HARD COATINGS PREPARED FROM LIQUID MIXTURES OF
ERYTHRITOL AND SORBITOL

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This is a:

- ☐ Provisional Application
- ☒ Regular Utility Application
- ☐ Continuing Application
- ☐ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application
- ☐ Substitute Specification
Sub. Spec Filed _____
in App. No. 1
- ☐ Marked up Specification re
Sub. Spec. filed _____
In App. No. 1

SPECIFICATION

Sugar-free hard coatings prepared from liquid mixtures of erythritol and sorbitolTechnical field

The present invention relates to a sugar-free hard coating prepared from a liquid coating syrup comprising a mixture from sorbitol and erythritol. The present invention relates to sugar-free hard coatings giving good adhesion to cores consisting of edible, chewable or pharmaceutical components. The invention also relates to products coated with the said compositions. The coatings based on the compositions of the present invention show good crispiness and/or crunchiness.

Background of the invention

Conventional panning procedures to prepare hard coatings generally work with sucrose, but recent advances in panning have allowed the use of other carbohydrate materials to be used in the place of sucrose. Sucrose proves to be detrimental for teeth and causes dental caries due to easy formation of acids. Therefore coatings are nowadays increasingly made of sugar-free compositions.

US 4,127,677 describes a sugarless xylitol-coated chewing gum, which delivers an intense cooling effect and which has a pleasant smooth feel. However the cost of xylitol is quite high and partial replacement of xylitol in the coating would be an advantage.

To obtain good hard coatings, fast even crystallisation must occur during application and drying.

WO 95/07625 describes the advantages of at least partial replacement of xylitol with erythritol in chewing gum coating. In a specific example erythritol and xylitol are used together in a single layer, since both polyols are co-crystallised. Preferably the xylitol portion of the solids in the solution should be about 40% to about 80% xylitol, with the solids in the solution comprising about 20% to about 60% erythritol. However, example 6 demonstrates that the hard coating easily peels from the gum core and it has a slight sandpaper finish. This example demonstrates that application of polyol mixtures in hard coatings is very sensitive to the ratio of the polyols and depends on the kind of

polyol applied. Furthermore, the appearance of the coating is sometimes affected by the crystallisation difficulties.

On the other hand sorbitol has been suggested as a substitute for sugar in sugarless preparations. However, it is common general knowledge that sorbitol can be used as an ingredient of the core but difficulties might arise to apply sorbitol in hard coatings, due to its hygroscopic nature. The major drawback of the use of sorbitol is that the resulting coating layers do not show the same crunchiness and crispiness as the conventional sucrose-based coatings.

US 4,238,510 discloses a method for sorbitol coating wherein it is ensured that the sorbitol crystallises. By this method cycles are repeatedly carried out comprising a) application of a first coating syrup containing sorbitol, an adhesion or binder component and a film-forming agent, b) application of a dry dusting powder in the form of a mix comprising sorbitol in a powdered form, a moisture absorbing component, an anti-sticking component and a dispersing agent. It is believed that the crystalline powder acts as a seed crystal for the saturated sorbitol solution. However, the obtained result is not satisfactory since the coating layer is not evenly distributed, and rough surfaces are obtained, while the hard coating is not as crunchy as is obtained with normally employed sugars.

US 4,423,086 describes that hard coatings based on sorbitol can be obtained when applying a coating syrup having a concentration of dry matter comprised between 60 to 85% by weight and the richness of the syrup in sorbitol being greater than 80%, preferably greater than 95%, and still more preferably greater than 99%. On the other hand the sorbitol based coatings are less expensive but lack the important cooling effect of the hard coatings based on xylitol which is giving the pleasant smooth feeling and which is especially desirable for the application of hard coatings of chewing gums. In this respect, sorbitol coatings are improved by the addition of other polyols, which have this important cooling effect.

However US 5,536,511 mentions that it has been difficult in practice to use more than 5% sorbitol in a xylitol panning coating, and at these low levels, sorbitol acts as a crystallisation modifier. These coatings with limited amount of sorbitol lack the cost-effective advantage.

So far sorbitol based hard coatings contain either more than 80% sorbitol, preferably more than 99% sorbitol, or the hard coatings are based on mixtures of sorbitol with other polyols such as xylitol, but then the quantity of sorbitol is practically limited to 5%.

EP 0813817 discloses a process for coating cores with mixtures of sorbitol and other polyols, wherein the concentration of sorbitol is not limited to 5%. The applied process is different from the panning procedures, which are applying solely liquid coating syrups, and consequently the obtained products are different. The sorbitol syrup is applied to a rotating mass of cores and then at least one other polyol is added in a crystalline form. Preferably, the polyol is selected from the group consisting of Isomalt[†], xylitol, and erythritol. The crunchiness is at least comparable to that obtained with sucrose. However, the mentioned method requires the addition of the second polyol in crystalline form. Accordingly, a need exists in the market place for a cheap sugarless coating prepared from liquid mixtures of polyols, resulting in a crunchy hard coating, which is well adhered to the gum base.

Summary of the invention

The present invention relates to sugar-free hard-coated comestibles consisting of a hard coating and an edible, chewable and/or pharmaceutical core characterised in that at least one layer of the hard coating is comprising a mixture of sorbitol and erythritol wherein the dry substance of the mixture is comprising between 1% to 50% w/w erythritol.

The present invention relates to sugar-free hard-coated comestibles wherein the dry substance of the mixture comprises between 5% to 50% w/w erythritol, preferably between 5% to 45% w/w erythritol, more preferably between 20% to 45% w/w erythritol.

The present invention further relates to sugar-free hard-coated comestibles wherein the layer of the hard coating comprising a mixture of sorbitol and erythritol is effecting good adhesion to the core.

The present invention discloses sugar-free hard-coated comestibles wherein the layer of the hard coating is comprising binding agents, dispersing agents, film formers, colouring agents, and/or flavouring agents.

The present invention further relates to sugar-free hard-coated comestibles wherein the hard coating consists of from 1 to 100 layers.

The sugar-free coatings of the present invention are used for coating the cores selected from the group consisting of pharmaceutical tablets, chewing gum, confectionery products (such as candies), chocolate and nuts.

The present invention discloses hard-coated comestibles, which are coated by applying the rotating panning process. The process for preparing sugar-free hard-coated comestibles comprises the addition of a liquid coating syrup to the moving mass of the cores in a rotating pan characterised in that the liquid coating syrup is comprising a mixture of sorbitol and erythritol wherein the dry substance of the mixture is comprising between 1% to 50% w/w erythritol, and the application of the layers is repeated up to 100 times.

Brief description of the drawings

Figure 1 is a scanning electron microscope picture, with magnification of 250x, measured at 10 kV, of the cross-section of a gold-coated sample.

It shows the hard coating prepared with the liquid coating syrup of the mixture of 60% w/w sorbitol and 40% w/w erythritol.

It is clearly seen that the hard coating is very well adhered to the gum base.

Figure 2 is a scanning electron microscope picture, with magnification of 250x, measured at 10 kV, of the cross-section of a gold-coated sample.

It shows the hard coating prepared with the liquid coating syrup of the mixture of 40% w/w xylitol and 60% w/w erythritol.

It is clearly seen that the hard coating is less good adhered to the gum base.

Figure 3 is a scanning electron microscope picture, with magnification of 3000x, measured at 10 kV, of the cross-section of a gold-coated sample.

It shows that the hard coating, prepared with the liquid coating syrup of the mixture of 60% w/w (based on dry substance) sorbitol and 40% w/w erythritol, is homogeneous and there is a uniform distribution of the erythritol and sorbitol crystals.

Figure 4 a scanning electron microscope picture, with magnification of 3000x, measured at 10 kV, of the cross-section of a gold-coated sample.

It shows that the hard coating, prepared according to the process described in EP 0813817, is heterogeneous and it is consisting of big erythritol crystals in the sorbitol matrix.

Detailed description of the invention

The present invention relates to sugar-free hard-coated comestibles consisting of a hard coating and an edible, chewable and/or pharmaceutical core characterised in that at least one layer of the hard coating is comprising a mixture of sorbitol and erythritol and wherein the dry substance of the mixture is comprising between 1% to 50% w/w erythritol.

The present invention relates to sugar-free hard-coated comestibles wherein the dry substance of the mixture comprises between 5% to 50% w/w erythritol, preferably between 5% to 45% w/w, more preferably between 20% to 45% w/w erythritol.

The present invention discloses liquid coating syrups comprising mixtures of sorbitol and erythritol, wherein the dry substance of the mixture is comprising between 1 to 50% w/w erythritol, preferably between 5% to 45% w/w, more preferably between 20% and 45% w/w erythritol. These coating syrups give rise to crispy and/or crunchy hard coatings with a uniform smooth surface and with good adhesion to the core. At least one layer of the hard coating is comprising a mixture of sorbitol and erythritol, and this layer is effecting the good adhesion to the core.

Sorbitol is defined as the hydrogenated product resulting from dextrose or glucose syrups that are containing higher polyols, and sorbitol is applied in solid or liquid form.

Erythritol may be obtained by a fermentative process or it may also be obtained from a chemical process such as the conversion of dialdehyde starch, tartaric esters or tartaric acid, and it gives the same cooling effect as xylitol. Moreover erythritol does not contribute to dental caries, does not significantly contribute to calories and does not cause gastric distress like some other polyols. Erythritol is available as non-hygroscopic crystalline powder.

The present invention discloses the preparation of hard-coated comestibles, which consists of a hard coating and an edible, chewable and/or pharmaceutical core and wherein the hard coating is adhered well to the core. At least one layer is prepared from the liquid mixture of sorbitol and erythritol to obtain the good adhesion to the core. This layer may be the first layer which is in direct contact with the core, and/or it may be a layer which is close enough to the core for effecting good adhesion to the core. The other layers may consist of single polyols. Preferably the sugar-free coatings of the present invention are used for coating pharmaceutical tablets, chewing gum, confectionery products (such as candies), chocolate and nuts.

When the present invention is applied for hard coating of chewing gum, any conventional chewing gum centre (core) may be used. Preferably the centre is sugar-free and constitutes from about 35 to about 65% of the chewing gum product.

Liquid coating syrups devoid of any binding or film forming agent, but consisting of a mixture of sorbitol and erythritol wherein the dry substance of sorbitol in the mixture is lower than 50% w/w, give rise to rough irregular surfaces. Mixtures of sorbitol and erythritol, wherein the dry substance of sorbitol in the mixture is lower than 50% w/w, may however give rise to smooth regular surfaces when applying liquid coating syrups that contain additional ingredients, such as binding agents, or film forming agents.

The best results are obtained with liquid coating syrups comprising mixtures wherein the dry substance of the mixture is consisting of 60% w/w sorbitol and 40% w/w erythritol.

The composition of the liquid coating syrup is not limited to the mixture of sorbitol and erythritol, but it may contain additionally some other ingredients such as artificial sweeteners, dispersing agents, colouring agents, film formers, binding agents, and/or flavouring agents.

The coating syrup is initially present as a liquid syrup which contains from about 30% to 80% or 85% dry substance consisting of the coating ingredients previously described herein, and from about 15% or 20% to about 70% of a solvent such as water.

In general, the hard coating process is carried out in a rotating pan. Cores to be coated are placed into the rotating pan to form a moving mass. The applied liquid coating syrup is comprising a mixture of sorbitol and erythritol wherein the dry substance of the

mixture is consisting of between 1% to 50% w/w erythritol. This material or syrup, which will form the hard coating is applied or distributed over the cores and drying is performed with air. The drying air is in the temperature range of from about 15 to 45°C and a moisture content of at most 50% relative humidity is applied. Each component of the coating on the core may be applied in a single hard layer or in a plurality of hard layers. In general a plurality of layers is obtained by applying single coats, allowing the layers to dry, and then repeating the process. Any number of the coats may be applied to the core. Coatings of from 1 to 100 layers are easily obtained, preferably the number of layers is between 1 and 40. The optimal amount of layers will depend on the desired application and can be determined experimentally.

The effectiveness of the hard coating, prepared according to the present invention is compared to the hard coating prepared from a liquid coating syrup containing erythritol and xylitol (example 3). The hard coating prepared from the liquid mixture of sorbitol and erythritol is superior in quality, since the adhesion to the gum core is much better.

Furthermore, in a comparative example the hard coating of the current invention is compared with the hard coating prepared according to the process as it is described in EP 0813817. The scanning electron microscope pictures (figure 3 and 4) clearly demonstrate that the different processes give rise to different products.

The present invention is illustrated by way of the following examples.

Example 1

Panning conditions

To prepare the liquid mixture of sorbitol/erythritol 60/40 (trial 1), 11.2 kg erythritol (C☆Eridex 16952) were mixed with 16.8 kg sorbitol (C☆Sorbidex P16616) and 12 kg water. The resulting mixture was stored at 60°C.

The coating was performed in a pilot Driacoater.

50 kg cores, wherein the weight of uncoated centres was 0.9 g each, were rotating at 8 rpm and 0.6 kg of coating syrup was applied each time. The drying step was carried out by blowing air in at the bottom of the drying pan at 24°C.

Further applied panning conditions are mentioned in Table 1.

Table 1

Conditions	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Drying T(°C)	24	24	24	24	24	24	24
Total dosing (kg)	4.2	0.6	0.6	21.6	2.4	0.3	0.0
# kg/dosage	0.6	0.6	0.6	0.6	0.6	0.6	0.0
Smoothing t (sec)	25	60	25	60	240	300	300
Drying t (sec)	300	300	300	400	200	600	900

Figure 1 shows clearly that the hard coating is well adhered to the core.

Figure 3 (magnification of 3000) shows that the hard coating is homogeneous and there is a uniform distribution.

Example 2

Liquid mixtures with other ratios of sorbitol/erythritol were prepared. About 40 kg of total liquid mixture was prepared and each time 50 kg cores, wherein the weight of uncoated centres was 0.9 g each, were rotated in a pilot Driacoater at 8 rpm.

The other applied panning conditions are mentioned in Table 1.

The composition of the liquid mixture of sorbitol (S) and erythritol (E) for the coating syrup, its storing temperature and the resulting properties of the hard coating are mentioned in Table 2.

The coating syrups were devoid of binding, dispersing or film forming agents and the resulting hard coatings were compared to the hard coating prepared in trial 1 (example 1).

Table 2

Trial	Composition: weight ratio sorbitol(S)/ Erythritol (E), based on dry substance of mixture	Dry substance of coating syrup (%)	Temperature (°C) of coating solution	Physicochemical- Organoleptic Evaluation
2	S/E 30/70	70	65	Rough surface, powdery
3	S/E 40/60	70	65	Rough surface
1	S/E 60/40	70	60	Smooth transparent surface, crunchy coating, cooling effect
4	S/E 80/20	70	50	Smooth transparent surface, crunchy coating, cooling effect

Example 3

A liquid mixture of erythritol and xylitol was prepared from 11.2 kg xylitol and 16.8 kg erythritol, 2 kg gelatine (33%) and 11.2 kg water. Everything was mixed and stored at 65°C.

A pilot Driacoater was filled with 50 kg cores, wherein the weight of uncoated centres was 0.9 g each, and the liquid mixture was applied while rotating at 8 rpm.

Further applied panning conditions are mentioned in Table 3.

Table 3

Conditions	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
Drying T(°C)	24	24	24	24	24	24
Total dosing (kg)	0.6	0.6	2.4	24	1.2	0.0
# kg/dosage	0.3	0.6	0.6	0.8	0.6	0.0
Smoothing t (sec)	45	45	30	20	20	500
Drying t (sec)	250	300	275	350	275	500

The obtained results are displayed in Table 4.

Table 4.

Trial	Mixture	Ratio	Temperature (°C)	Dry substance (%)	% gelatine	Evaluation
1	S/E	60/40	75	70	No addition	Crunchy
5	X/E	40/60	65	70	1%	Bad adhesion

Figure 2 corresponds to the hard coating prepared in trial 5. It is clearly demonstrated that the hard coating is less good adhered to the core. This is in clear contrast to the good adhesion of the hard coating prepared according to trial 1, which is shown in figure 1.

Figure 3 corresponds to the hard coating prepared in trial 1, but a magnification of 3000 is applied. It shows that the hard coating, prepared with the liquid coating syrup of the mixture of 60% w/w (based on dry substance of the mixture) sorbitol and 40% w/w erythritol, is homogeneous and there is a uniform distribution.

Comparative example

The process as it is described in EP 0813817 was repeated.

The coating solution was a sorbitol syrup with dry substance of 70% and a sorbitol-content of 97%. The syrup was applied to the cores at room temperature (20 - 25°C).

2 kg cores were in a rotating pan (speed 20 rpm, diameter 0.5m, velocity at outer circumference 1m/s). For the first ten layers 10 ml of sorbitol syrup was added. From

layer twenty the amount was increased to 25 ml and from layer 37 it was further increased to 35 ml. Every fifth layer 1 min. after the addition of the sorbitol solution 0.57% (based on the weight of the centres) of C☆Eridex was added as a solid material.

The coating process was stopped after 40 layers.

Figure 4 corresponds to the hard coating prepared according to this process. The hard coating is heterogeneous and it is consisting of big erythritol crystals in the sorbitol matrix. This is completely different from the hard coating prepared according to the current invention and displayed in figure 3.

Claims

1. Sugar-free hard-coated comestibles consisting of a hard coating and an edible, chewable and/or pharmaceutical core characterised in that at least one layer of the hard coating is comprising a mixture of sorbitol and erythritol wherein the dry substance of the mixture is comprising between 1% to 50% w/w erythritol.
2. Sugar-free hard-coated comestibles according to claim 1 characterised in that the dry substance of the mixture comprises between 5% to 50% w/w erythritol, preferably between 5% to 45% w/w, more preferably between 20% to 45% w/w erythritol.
3. Sugar-free hard-coated comestibles according to claim 1 or 2 characterised in that the layer of the hard coating comprising a mixture of sorbitol and erythritol is effecting good adhesion to the core.
4. Sugar-free hard-coated comestibles according to anyone of claims 1 to 3 characterised in that the hard coating comprises binding agents, dispersing agents, film formers, colouring agents, and/or flavouring agents.
5. Sugar-free hard-coated comestibles according to anyone of claims 1 to 4 wherein the hard coating consists of from 1 to 100 layers.
6. Sugar-free hard-coated comestibles according to claim 1 wherein the core is selected from the group consisting of pharmaceutical tablets, chewing gum, confectionery product, chocolate and nut.
7. A process for preparing sugar-free hard-coated comestibles comprising the addition of a liquid coating syrup to the moving mass of the cores in a rotating pan characterised in that the liquid coating syrup is comprising a mixture of sorbitol and

erythritol wherein the dry substance of the mixture is comprising between 1% to 50% w/w erythritol.

8. A process according to claim 7 wherein the application of the layers is repeated up to 100 times.

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Abstract

The present invention discloses a sugar-free hard coating prepared from a liquid coating syrup comprising a mixture from sorbitol and erythritol. Coating with liquid mixtures of sorbitol and erythritol gives a crunchy hard coating, which is well adhered to the gum base. The invention also relates to products coated with the said compositions.

Figure 1

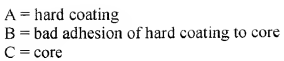


A = hard coating

B = adhesion of hard coating to core

C = core

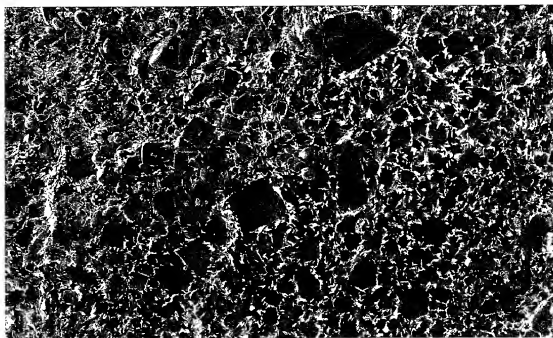
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	



B = bad adhesion of hard coating to core

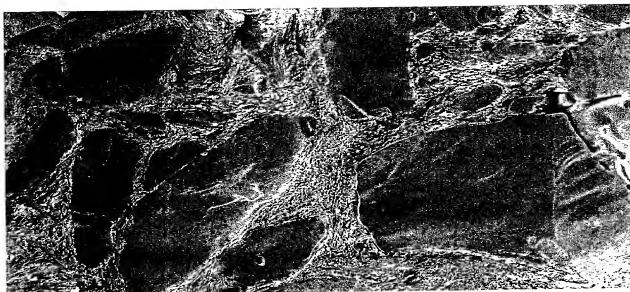
C = core

Figure 3



A = hard coating

Figure 4



← A

A = hard coating

As a below named inventor, I hereby declare that my residence, past office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the INVENTION ENTITLED Sugar free hard coatings prepared from liquid mixtures of acrylonitrile and acrylate

the specification of which (CHECK applicable BOX(ES))
X ☐ is attached hereto.
BOX(ES) ☐ was filed on 11/19/95 as U.S. Application No. 0 / 1 on 11/19/95
☐ and (U.S. or PCT application amended) was amended on 11/19/95

I hereby declare that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application:

PRIOR FOREIGN APPLICATION(S)	Date first Land- open or Published	Date Patented or Granted	Priority Claimed
Number	Country	Day/MONTH/Year Filed	Yes No
9912813.4	United Kingdom	3/06/1999	X

I hereby claim domestic priority benefit under 35 U.S.C. 119/120/365 of the indicated United States applications listed below and PCT international applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application:

PRIOR U.S. PROVISIONAL NONPROVISIONAL AND/OR PCT APPLICATION(S)	Status	Priority Claimed
Application No. (series code/serial no.)	Day/MONTH/Year Filed	pending, abandoned, patented
		Yes No

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I and I hereby appoint Pillsbury Madison & Sutro LLP, Intellectual Property Group, 1100 New York Avenue, N.W., Ninth Floor, East Tower, Washington, D.C. 20005-3918, telephone number (202) 861-3000 (to whom all communications are to be directed), and the below-named persons (of the same address) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete names/numbers below of persons no longer with their firm and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above firm and/or a below attorney in writing to the contrary.

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(FOR ADDITIONAL INVENTORS, check box ☐ and attach sheet (PAT-116.2) for same information for each re signature, name, date, citizenship, residence and address.)